

## Revegetation case study - 2000

### Breakaway Revegetation

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#### Landscape Goal

Provide adequate habitat within the Wallatin Creek Catchment by increasing amount of effective habitat to conserve existing resident flora and fauna in the catchment and improve sustainability of land use.

#### Nature Conservation

- Increase the size of the remnant
- Increase corridor width between the Nature Reserves.

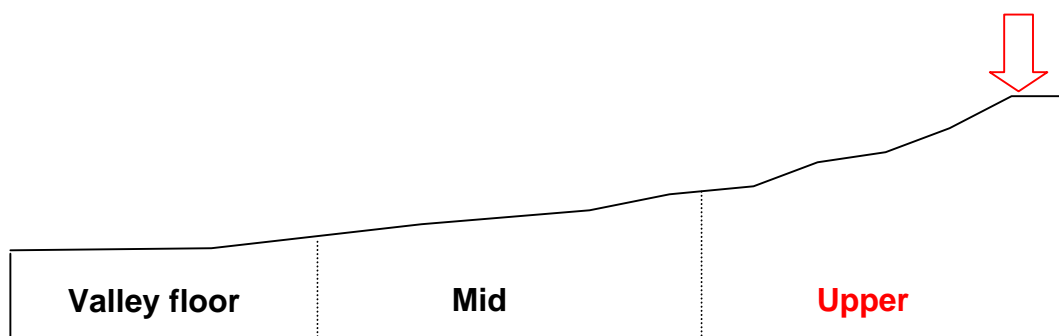
#### Sustainable Agriculture

- Eliminate surface water runoff from above the breakaway.
- Increase use of annual rainfall in a high recharge area.



NOT TO SCALE

## Site Characteristics



**Figure 2. Landscape position of revegetation.**

<b>Soil type:</b>	Yellow gradational loamy sand overlying mottled zone. pH = 9.8 (7 = neutral), soil salinity EC = 10 milli seimens per metre (< 17 mS/m is non saline)
<b>Landform:</b>	Ulva soil landscape unit on a ridge above a breakaway (eroded edge of uplands) of the upper slopes.
<b>Remnant Vegetation:</b>	The revegetation site improves the linkages to the Durokoppin Nature Reserve (1103ha), Kodj Kodjin Nature Reserve (237 ha) and the Water Reserve (31 ha).
<b>Vegetation Association:</b>	Mixed heathland dominated by Allocasuarina species.
<b>Potential Recharge:</b>	High
<b>Area:</b>	Approximately 5 hectares, 500 metres long
<b>Rainfall:</b>	Average annual rainfall is 330mm, the annual rainfall for 2000 was 407 mm with 159 mm in the growing season (May to October).
<b>Paddock history:</b>	Wheat: Pasture: Wheat

## Design of Revegetation

### Species Selection

A natural association of local species was selected based on soil and landforms (table 1). Note that the white gum associated with this woodland is *Eucalyptus capillosa*, also known as inland wandoo or wheatbelt wandoo.

**Table 1. Woodland species selected for revegetation**

Genus	species	Common name	Fire response	Seedling #	seed g (for direct seeding)
<b>White gum woodland</b>					
<i>Acacia</i>	<i>acuaria</i>		seeder		40g
<i>Acacia</i>	<i>acuminata</i>	Jam wattle	Seeder	504	200g
<i>Acacia</i>	<i>hemiteles</i>	Tan wattle		60	20g
<i>Allocasuarina</i>	<i>acutivalvis</i>	Black tamma	Seeder		200g
<i>Allocasuarina</i>	<i>campestris</i>	Tamma	Seeder	360	94g
<i>Eucalyptus</i>	<i>capillosa</i>	Inland wandoo or white gum	Seeder	1020	250g
<i>Eucalyptus</i>	<i>loxophleba</i>	York gum	Resprouter	180	
<i>Eucalyptus</i>	<i>sheathiana</i>	Ribbon bark gum		300	
<i>Eucalyptus</i>	<i>subangusta</i>	Black marlock		900	
<i>Calothamnus</i>	<i>quadrifidus</i>	One sided bottlebrush	Resprouter	180	
<i>Hakea</i>	<i>lissocarpha</i>	Honey bush	Resprouter	224	1g
<i>Hakea</i>	<i>scoparia</i>		Seeder		38g
<i>Hakea</i>	<i>trifurcata</i>	Two-leaf hakea	Seeder		6g
<i>Melaleuca</i>	<i>coronicarpa</i>	Hidden honey-myrtle		300	
<i>Melaleuca</i>	<i>radula</i>	Graceful honey myrtle	Resprouter		51g
<i>Senna</i>	<i>nemophila</i>	Desert cassia			37g
<i>Melaleuca</i>	<i>uncinata</i>	Broombush	Resprouter	900	198g
<i>Allocasuarina</i>	<i>acutivalvis</i>	Black Tamma	Seeder		96g
<b>Scrub heath</b>					
<i>Acacia</i>	<i>44</i>				27g
<i>Acacia</i>	<i>lasiocalyx</i>	Caterpillar wattle	Seeder		20g
<i>Allocasuarina</i>	<i>acutivalvis</i>	Black tamma	Seeder		200g
<i>Allocasuarina</i>	<i>campestris</i>	Tamma	Seeder		100g
<i>Hakea</i>	<i>erecta</i>	Hakea	Seeder		
<i>Hakea</i>	<i>incrassata</i>	Marble hakea	Resprouter		22g
<i>Hakea</i>	<i>platysperma</i>	Cricket ball hakea	Seeder		74g
<i>Isopogon</i>	<i>dubis</i>	Rosy cone flower			100g
<i>Melaleuca</i>	<i>cordata</i>				6g
<i>Melaleuca</i>	<i>leptospermoides</i>				8g

**Note:** Seeder/Resprouter refers to the main form of regeneration, especially after fire.

## Nature conservation issues

### ➤ **Focal species requirements**

The size of the remnant was increased by 5 hectares to meet the minimum size (25ha) requirements of area limited species to maintain the breeding viability of the most sensitive fauna. The width of the corridor has increased, to improve the connectivity between remnants.

### ➤ **Natural plant associations**

A range of vegetation associations were incorporated to mimic the natural composition of similar landforms. Each association contained a mix of 3-5 species that naturally occur together within the white gum woodland. The associations were planted with irregular boundaries and clumping, reflecting the structure of natural associations.

### ➤ **Provenance protection**

Special permission was granted by the Department of Conservation and Land Management to allow all the seed to be collected from the neighbouring three Nature Reserves: Durokoppin, Kodj Kodjin and Burgess Spring in the Kellerberrin Shire. All lie within a 5-10km radius of the revegetation site. This seed was propagated in selected nurseries for planting onto specific sites.

### ➤ **Vegetation structure**

The seedlings were planted at a density of 1000 stems per hectare averaging three metre spacings. Patches of single species understorey were planted randomly throughout at a density of 120 seedlings in 10m x 10m squares. Habitat patches were planted to provide feeding and nesting substrate for birds, *Calothamnus quadrifidus* is one of six species that was planted. These patches will provide structure to the revegetation in the form of understorey layers. While the overstorey is dominated by Eucalypts, these were often planted in clumps.

### ➤ **Remnant protection**

The seedlings were planted along the remnant bush of the breakaway to protect the quality of the remnant. The connectivity between the two neighbouring Nature Reserves will be maintained with this revegetation. The planting is positioned on the upside of the breakaway vegetation. Below the breakaway is a planting completed by the farmer one year earlier. These planting's will protect the remnant vegetation from edge effects of fertiliser drift, spray drift and weed invasion. The whole breakaway remnant was fenced to protect the revegetation from stock grazing and minimising erosion.

### ➤ **Level of Diversity**

The diversity of plants used included species that had readily accessible seed and were mature in time for seed collecting and delivery to the nurseries in early December, for propagation in the 2000 planting season. Eight genera and 13 different species of local provenance plants were used in the revegetation design.

### ➤ **Threats to revegetation**

Fire is the primary threat to the revegetation. A mix of species that regenerate after fire by seed or resprouting was chosen to improve the probability of plants regenerating after fire.

### Agricultural land use issues

#### ➤ **Protecting a highly erodible site**

Revegetating above the breakaway will protect the vulnerable soils from wind and water erosion. The existing revegetation below breakaway will also protect the fragile landform.

#### ➤ **Increase water use**

A density of 1000 stems per hectares at 3 x 3 metre spacings will increase water use and help dry the soil profile. This will be particularly effective in this part of the catchment, as it has been defined as a high potential recharge area.

## **Establishment**

### ➤ **Site preparation**

The site was ripped using the Shire grader at one metre spacings on the 30 April 2000 to an average depth of 20 – 30cm. The entire site was then cultivated with a scarifier to create a smooth and even surface. Cultivation of the entire site enabled the planting to be uneven and scattered throughout.

### ➤ **Weed control**

The area to be planted with seedlings was sprayed with one litre of Credit/Bonus (glyphosate), two litres of Simazine and one litre of Atrazine on the 15 May 2000. The site was then sprayed with two litres Round-up (glyphosate) per ha on 15 July 2000. Late and minimal rains delayed herbicide application. The direct seeding site was sprayed with one litre of Credit/Bonus (glyphosate) per ha mixed with 75 ml Cypermethrin and 70ml Chlpyrifos (insecticide for red legged earth mite) per ha. A second (15 July 2000) and third (1 August 2000) application of two litres of Roundup was used to control late germination of weeds on the direct seeded site.

### ➤ **Planting design**

Vegetation formations were pegged prior to planting so that the revegetation would represent irregular natural boundaries. A mix of 3-5 different species was arranged before planting to ensure smooth delivery of seedlings into changing planting patterns. The seedlings were planted randomly with 'potti putki' hand planters into the cultivated area on 22 July 2000. Habitat patches were pegged prior to planting at 10m x 10m squares scattered throughout each vegetation association. The seedlings within the patches were planted at one metre spacings to create a thicket effect.

### ➤ **Direct seeding method**

Direct seeding areas were seeded on the 14 August 2000 using the broadcast method. One part of seed was mixed with 4 parts vermiculite and 5 parts coarse brown sand as bulking agent in a cement mixer. Prior to mixing the Acacia species were treated with boiling water for 30 seconds and the Isopogon species was treated with a smoked water solution. Spreading of the seed mix occurred immediately following cultivation. The seed mix was spread by hand across the sites. After seeding, the site

was sprayed with 200ml per ha of Talstar® to give 60 days residual control of red legged earth mite.

➤ **Implementing the revegetation works**

The schedule and description of revegetation works undertaken are summarised below in table 1 and 2 for seedlings and direct seeding.

**Table 2. Schedule of Works – Seedlings**

TASK	ACTION	OUTCOME	COMMENTS
<b>Site preparation</b>	Ripped using Shire grader 1m spacing 30/4/00. Then cultivated over the entire area.	Deep rip lines lost under cultivations.	Lack of depth to plant seedling into when rip line unidentifiable.
<b>Weed control</b>	1L Credit/Bonus, 2L Simazine, 1L Atrazine on 15/5/00 2L Roundup on 15/7/00 before planting	Late and minimal rains delayed spraying and made weed control less effective. A second application of roundup necessary	Good weed control despite difficult conditions. Late germination after planting of wild radish.
<b>Seedling quality at time of planting</b>	Seedlings kept outside in weather (rain). Loaded the night before planting.	Good quality seedlings.	Easy to handle during planting.
<b>Planting</b>	Hand planting using potti putkis 6 people planting 2 popping seedlings out; Kit, Craig, Freo Lions Club	8am start 1.30pm finish 78 trays/6 planters/5.5 hrs = 2.4 trays/person/hour	Well-planted seedlings, good conditions for planting.

**Table 3. Schedule of Works – Direct Seeding**

TASK	ACTION	OUTCOME	COMMENTS
<b>Site preparation</b>	Ripped using Shire grader 1m spacing 30/4/00. Then cultivated over the entire area.	Rip lines lost under cultivations.	Lack of depth to plant seedling into when rip line unidentifiable.
<b>Weed control</b>	1L Credit/Bonus, 75ml Cypermethrin, 70ml Chlpyrifos on 15/5/00, 2L Roundup on 15/7/00 and 2L Roundup on 1/8/00	Late and minimal rains delayed spraying and made weed control less effective. A second and third application of roundup necessary	Good weed control despite difficult conditions. Late germination after planting of wild radish.
<b>Method of Direct Seeding</b>	Broadcast seeding (14/8/00) using vermiculite and coarse sand as bulking agent. Sprayed with 500ml of Talstar (same day)	Even coverage of seed and bulking agent. No signs of insect attack.	Small amounts of rainfall seeding and soil temperature warming up very quickly may have affected germination.
<b>Germination</b>	Hakea platysperma 19/9/00, Allocasuarina spp, Acacia spp, Hakea spp germination noted on 16/11/00		Later germination due to lack of rainfall?

## Layout of revegetation

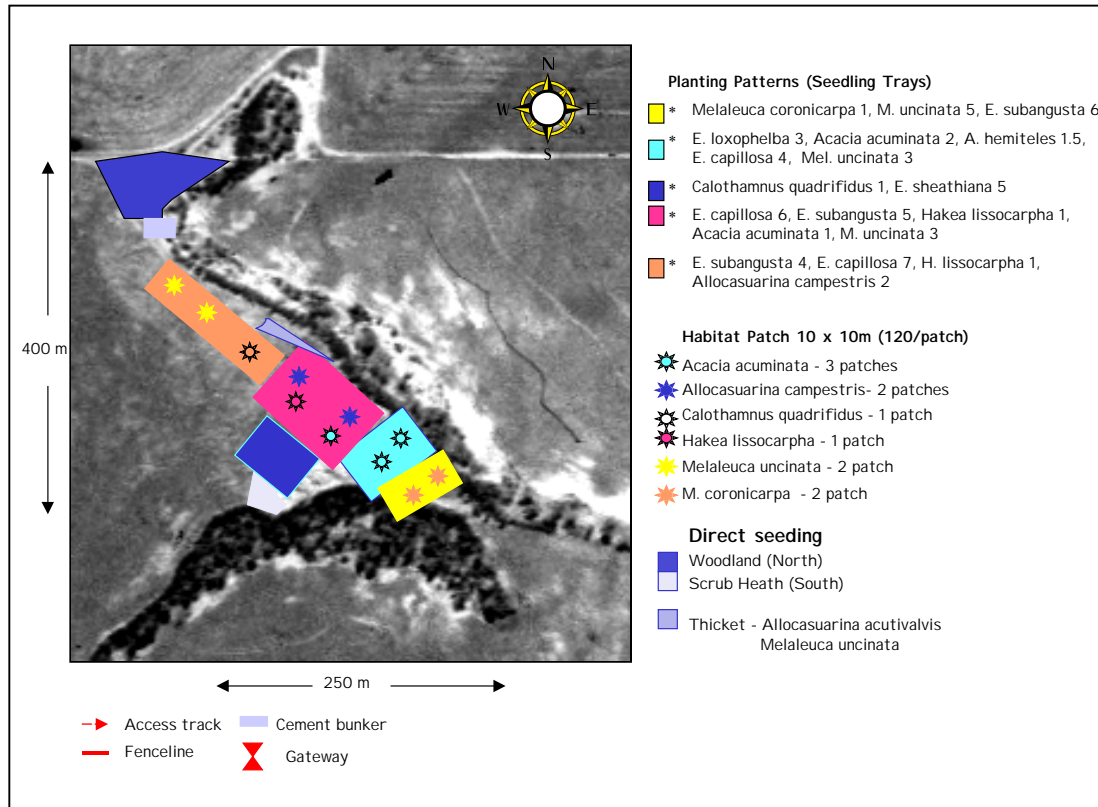


Figure 3. Planting patterns for the breakaway revegetation design, (60 seedlings per tray).

## Costs

### ➤ Cost sharing arrangements

The revegetation design was cost shared on its value to nature conservation (Departmental share) and profitable sustainable agriculture (landholder share). This site had a cost share ratio of 5:2, five points to nature conservation values and two points to sustainable agriculture.

The nature conservation value was met by using a multiple species planting of local provenance species that provides an important habitat for locally threatened species and contributes to recharge control that protects priority bush (237 ha Nature Reserve). The sustainable agricultural value was met by the revegetation contributing to recharge control of the adjacent farmland (very high - high potential recharge) and protecting a highly erodible site.

The Bushcare funded, Department of Conservation and Land Management managed project contributed 43 cents per planted seedling out of a total of 60 cents per planted seedling. The revegetation site was funded at 85% of the cost of fencing materials as the revegetation linked to priority bush areas. For details on cost sharing method see Mullan 2001.



**Table 4. Cost of establishment (2000).**

<b>Materials and activities</b>	<b>Itemised costs</b>	<b>Total cost</b>
5164 Mixed species seedlings	@ 34c per seedling 5164	\$1755.76
Rabbit control – 1080 poisoned oats	@ \$7.72 / km x 7km	\$54.04
Ripping – @ 2m spacings	@ 10c per planted seedling 5164	\$516.40
Cultivation - @ 2m spacings	@ 7c per planted seedling 5164	\$361.48
<b>Seedling - Weed control</b> 1 <sup>st</sup> Application: 1L/ha Glyphosate 2L/ha Simazine and 1L/ha Atrazine	@ 9 c per planted seedling 5164	\$464.76
2 <sup>nd</sup> application: 2L/ha Glyphosate	\$10/ha x 5	\$50.00
Hand planting 6 planters	@ 10 c per planted seedling 5164	\$516.40
<b>Direct Seeding</b> Local provenance seed 1 kilo/ha Bulking agent – vermiculite	@ \$516 / ha x 1.5ha @ \$16 / 100L	\$774.00 \$16.00
<b>Weed Control</b> 3 <sup>rd</sup> application: 2L/ha Glyphosate	\$10/ha x 1.5	\$15.00
<b>Pest Control</b> 1 <sup>st</sup> application: 70 mL Chlorpyrifos and 75 mL Cypermethrin	\$1.82 / ha x 1.5ha	\$2.73
2 <sup>nd</sup> application: 250 mL/ha Talstar	\$22.50/ha x 1.5ha	\$33.72
Fencing – 7 line hinged joint ringlock	@ \$1150 per km x 5km	\$5750.00
<b>TOTAL COST</b>		<b>\$10 310.29</b>

## Monitoring

**Monitoring data:** 95% survival rate for seedlings with an evenly spread germination on the direct seeding sites.



**Figure 4. Direct seeding site, northern end September 02**